Epidemiological study of Hymenolepis nana in children in Kalar city / Sulaimani province

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Abstract:

A total of 321 stool samples from children (169 males and 152 females) attending to Kalar general hospital with complain of gastroenteritis were collected and tested. Microscopic examination of samples revealed that an overall of 4.04% (13/321) of children were infected with *H. nana*. The frequency of *H. nana* infection in preschool (1 - <6 years) and school age children (6-12 years) was 0.92% and 5.63%, respectively. Non significant difference (P>0.05) was observed between frequency of infected children in both ages. The frequency of *H. nana* was higher in males (5.32%) than in females (2.63%) but it was not significantly different (P>0.05). The highest frequency of *H. nana* infection was observed in school age children in both city center (7.77%) and villages (4.71%). No significance correlation (P>0.05) was observed between *H. nana* infection and gender, sources of drinking water and different localities of Kalar city. Significant difference (P<0.05) was observed between *H. nana* infections in orphan children and children whose father's employees, laborer, farmer, or idle. *H. nana* infection was not observed in children whose mother's were employed.

Key words: Hymenolepis nana, children, Mus muscular.

الخلاصة

لقد تم جمع وفحص 321 نموذجاً من عينات البراز التي أُخذت من الاطفال المراجعين لمستشفى العام لمدينة كلار وذلك بسبب وجود الاضطرابات مِعَدْيّة المعوية. ظهر من الفحص المجهرى للعينات, ان نسبة الاصابة الكلية بالدودة القزمية (H. nana) في الاطفال قد بلغت 4,04% (321\13). وقد بلغت نسبة الاصابة بالدودة القزمية بين الاطفال في عمر ماقبل مدرسة (1–<6 سنوات) وفي عمر المدرسة الابتدائية (6–12 سنوات 0,92% و5,63% على التوالي. ولم تظهر فروق احصائية (P> 0,05) في نسب الاصابة المئوية بين الفئتين العمريين اعلاه.

وكان نسبة الاصابة بالدودة القزمية اعلى في الذكور منه (5,32%) في الاناث (2,63%). ولم يلاحظ من نتائج الدراسة الحالية وجود فرقاً معنوياً (P> 0,05) بين نسب الاصابة بين الجنسين.كما لوحظ من نتائج الدراسة الحالية ان اعلى نسبة أصابة بهذه الدودة كانت في مركز المدينة (7.77%) اكثر من القرى والارياف (4,71%). ولم تظهر علاقة معنوية في نسب الاصابة بين الاجناس ومصادر مياه الشرب والمناطق المختلفة في مدينة كلار .ولوحظ وجود فرقاً معنوياً (P< 0,05) بين نسبة الاصابة بالدودة المحرشفة القزمة بين الاطفال الايتام وغيرهم من ذو الاباء الذين يعملون بمختلف الاعمال والذين لايعملون. ولم تسجل في الدراسة الحالية وجود حالات اصابة لمن كانت امهاتهم يعملن كموظفات في المهن الحكومية.

Introduction:

Hymenolepis species (H. nana and H. diminuta), infect humans, mice and rats, belong to the family Hymenolepididae. H. nana is a cosmopolitan dwarf tapeworm which is endemic in tropical and subtropical countries (1,2). The life cycle may be direct when the embryonated eggs are ingested with contaminated food, water or indirect, when embryonated eggs ingested by arthropods (beetles and fleas) as intermediate hosts. Humans and rodents are infected when they ingest cysticercoied-infected arthropods (1,3). Autoinfection can also occur when gravid proglottids release eggs inside the gut. Eggs hatch in the small intestine, liberating the oncospheres embryo, which then penetrates the lamina propria of the intestinal villi (4). The life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years (5). H. nana adults are very small, white when alive, body flattened, 25-80 mm long. The scolex bears four suckers and rostellum well developed with a circle of about 20-27 y-shaped hooks, proglottids numerous and transversely elongated. Its eggs are usually spherical, 30-54 µm in diameter, with a thin outer membranous shell and a thick internal embryophore containing the hexacanth embryo, on inner membrane are two small poles from which 4-8 filaments arise and spread out between the two membranes (6,1).

This study aimed to estimate overall prevalence of Hymenolepis spp. infections in children in Kalar city and to identify factors associated with infection including gender, age, school-related, parent's jobs, and different localities in Kalar city included city center, villages and regions.

Material and methods

1- Children:

This survey was conducted in Kalar general hospital from July 2009- February 2010. A single sample was collected from each child aged 1-12 years and sent for laboratory by physician for intestinal parasitic infection test, after a direct examination of wet mount in saline as well as in iodine by laboratory technician. About 1 gm of stool was taken by a wooden applicator stick and placed into a clean plastic container with good locked cover which labeled with identification number and date of collection. The samples were preserved in 10 ml of 10% formal saline until time of examination in the laboratory of microbiology in the college of education in Kalar /university of Sulaimani.

At the time of sample collection, structured pretested questionnaires were collected on the basis of patient's information. A formal- ether concentration technique was done for the assessment of results (7). An iodine stained slide was prepared and examined microscopically (X10 and X40).

Statistical analysis

Chi-square (x^2) test was used for statistical analysis of study results using statigraph soft ware program. A *P*- value of <0.05 denoted a statistically significant difference.

Results

A total of 321 stool samples from children attending to Kalar general hospital with complain of gastroenteritis were collected and tested. Microscopic examination of samples revealed that an overall of 4.04% (13/321) of children were infected with *H. nana*, no *H. diminuta* infection was detected among examined children. The frequency of *H. nana* infections in pre-school (1-<6 years) and school age (6-12 years) children was 0.92% and 5.63%, respectively. Non significant difference was observed between the frequencies of infected children with *H. nana* in both ages. The frequency of *H. nana* was higher in males (5.32%) than in females (2.63%) but it was not significantly different (Table 1).

Table 1: Distribution of *H. nana* infection according sex among preschool and school age children in Kalar city

Sex	Ages				Overall	
	Pre-school children		School children			
	Tested	Infected No. (%)	tested	Infected No. (%)	Tested	Infected No. (%) *
Male	59	0 (0.0)	110	9 (8.18)	169	9 (5.32)
Female	49	1 (2.04)	103	3 (2.91)	152	4 (2.63)
Total **	108	1 (0.92)	213	12 (5.63)	321	13 (4.04)

*- x^2= 0.13, df= 1, P-value= 0.718 with Yates' correction.
**- x^2= 2.37, df= 1, P-value= 0.123 with Yates' correction.

The highest frequency of *H. nana* infection was found in children who live in the city center and villages (4.79%, 4.46%), respectively, but infection was not detected in children who live in regions outside the center.

The highest frequency of *H. nana* infection was observed in school age children in both city center (7.77%) and villages (4.71%). The lowest frequency of *H. nana* infection was observed in preschool age children and infection only recorded in city center (1.29%), but infection was not found in villages and regions (Table 2).

Table 2: Distribution of H. nana infection according age among children in different localities of Kalar city

Age	City center		Villages		Regions		Overall	
	tested	Infected No. (%)	tested	Infected No. (%)	tested	Infected No. (%)	tested	Infected No. (%)*
Pre-school Children	77	1 (1.29)	6	0 (0.0)	14	0 (0.0)	97	1 (1.03)
School Children	90	7 (7.77)	106	5 (4.71)	28	0 (0.0)	224	12 (5.35)
Total **	167	8 (4.79)	112	5 (4.46)	42	0 (0.0)	321	13 (4.04)

*- x^2= 1.55, df= 1, P-value= 0.213 with Yates' correction.
**- x^2= 0.00, df= 1, P-value= 1.000 with Yates' correction.

The overall frequency of infection was higher in males (5.32%) than in females (2.63%) in different localities of Kalar city, with no significant statistical difference (Table 3).

Table 3: Distribution of H. nana infection according sex among children in different localities of Kalar city

Sex	City center		Villages		Regions		Overall	
	Tested	Infected No. (%)	tested	Infected No. (%)	Tested	Infected No. (%)	tested	Infected No. (%)
Male	79	5 (6.32)	69	4 (5.79)	21	0 (0.0)	169	9 (5.32)
Female	88	3 (3.40)	43	1 (2.32)	21	0 (0.0)	152	4 (2.63)
Total *	167	8 (4.79)	112	5 (4.46)	42	0 (0.0)	321	13 (4.04)

*- x^2= 0.00, df= 1, P-value= 1.000 with Yates' correction.

No significance correlation between H. nana infections in children and sources of drinking water was observed (Table 4).

Table 4: Distribution of H. nana infection in males and females children according to sources of drinking water

Sex	Closed[1] drinking water system		Opened[2] drinking water system		Overall	
	Tested	Infected No. (%)	Tested	Infected No. (%)	Tested	Infected No. (%)
Male	138	8 (5.79)	31	1 (3.22)	169	9 (5.32)
Female	133	3 (2.25)	19	1 (5.26)	152	4 (2.63)
Total *	271	11 (4.05)	50	2 (4)	321	13 (4.04)

*- x^2= 0.00, df= 1, P-value= 1.000 with Yates' correction.

[1]- Municipal and well water sources.

[2]- Spring and lake water sources.

The frequency of *H. nana* infection was higher in orphan children (14.28%) than in other children whose fathers are employees (2%), laborer (3.66%), farmer (6.38%), or idle (0.0%). Significant difference was observed between infection in orphan children and children whose fathers are employees, laborer, farmer, or idle. The highest percentage of *H. nana* infection was observed only in children whose mothers are housewives (unemployed) and infection was not recorded among children whose mothers were employed (Table 5).

Table 6: Distribution of H. nana infection in male and female children according their parents' jobs

Parent's work	Sex				Total	
Father's work	Male		Female			
	Examined	Infected No. (%)	Examined	Infected No. (%)	Examined	Infected No. (%)*
Orphan	4	1 (25)	3	0 (0.0)	7	1 (14.28)
Idle	1	0 (0.0)	10	0 (0.0)	11	0 (0.0)
Farmer	55	5 (9.09)	39	1 (2.56)	94	6 (6.38)
Laborer	58	3 (5.17)	51	1 (1.96)	109	4 (3.66)
Employees	51	0 (0.0)	49	2 (4.08)	100	2 (2)
Overall	169	8 (4.73)	152	5 (3.28)	321	13 (4.04)
Mother's work						
Housewives	145	9 (6.2)	143	4 (2.79)	288	13 (4.51)
Employees	24	0 (0.0)	9	0 (0.0)	33	0 (0.0)
Overall	169	9 (5.32)	152	4 (2.63)	321	13 (4.04)

*- x^2= 13.66, df= 3, P-value= 0.003

Table (7) shows the comparison between the results obtained using direct wet mount and concentration technique (formalin- ether sedimentation) during the present study. Higher positive samples were identified by formalin-ether sedimentation technique (4.04%) and only 1.55% was identified by direct wet mount.

Table 7: Identification of H. nana infection using different techniques

Methods of identification	Samples	
	Positive No. (%) *	Negative No. (%)
Direct smears methods	5 (1.55)	316 (98.44)
Formalin-ether concentration	13 (4.04)	308 (95.95)

*- x^2= 0.17, df= 1, P-value= 0.678 with Yates' correction.

Double infections with various intestinal parasites in combination with H. nana (38.46%) were identified also; H. nana was combined with Entamoeba histolytica (23.07%), with Giardia lamblia (7.69%) and Entamoeba coli (7.69%), respectively. Statistical analysis revealed that there is a significant difference ($P<0.05$) between combined infection of H. nana with Entamoeba histolytica and H. nana with Giardia lamblia and Entamoeba coli (table 8).

Table 8: Distribution of other intestinal parasites associated with H. nana infection among children in kalar city

Organisms	Number of double infection No. (%) *
H. nana + E. histolytica	3/13 (23.07)
H. nana + Giardia lamblia	1/13 (7.69)
H. nana + E. coli	1/13 (7.69)
Total	5/13 (38.46)

*- $x^2= 13.26$, df= 2, P-value= 0.001

Discussion

Intestinal parasitosis is considered an important public health problem in underdeveloped and developing countries (8). Epidemiological information on the prevalence of various intestinal parasitic infections in different regions/ localities is a prerequisite to develop appropriate control strategies (9). In Kalar only two epidemiological study have been carried out, one on enterobiasis (10) and other on giardiasis and entamoebiasis (11) in children of Kalar city.

However, there is an apparent lacks of epidemiological study about Hymenolepis infection in humans as well as in children. The present study involved epidemiological study of Hymenolepis infection in children in Kalar city.

A total of 321 children, 169 males and 152 females, were examined for the prevalence of Hymenolepis spp. infections. An overall of 13(4.04%) of examined children was infected with H. nana. This result is comparable to the previous studies in Erbil governorate (12,13,14,15), and in Sulaimani (16) and in Baghdad (17). And other studies in different countries like Pakistan (18), Cape in South Africa (19), Turkiye (8), Cambodia (20). This result is lower than other studies conducted in Iraq (in Thawra district in Baghdad (21), in

Kirkuk city (22), in Erbil city (23) and in Nineveh governorate (24)). It is also lower than studies conducted in the world (25,26,27,28). The higher prevalence rates of these studies may be due to poor hygienic condition, date of sampling, number of collected samples and sample collection more than once from each individual, methods of identification, low socioeconomic status and education level.

In the present study only H. nana infection was recorded among examined children. No H. diminuta was found among examined children. This finding is similar to the studies in Erbil (12,29,14,15,13) and in other countries (27,30,31,18,32,8,28,33,34).

The highest frequency of H. nana infection was observed in school age children but not significantly different from preschool children. This result is comparable to these studies (17,18). This may be related to school age children, in this age children start going outside of home. They do not take much care about the cleanliness of their hands and clothing. They take unhygienic food stuffs. They do not wash their hand frequently, particularly before meal and after going to latrine (18). Also may related to lake of sufficient water in basin and latrines, lake of soap on basin and hygienic services in most of the schools, overcrowding, most of the classes in schools of Kalar city (city center, villages and regions) contain about 40-50 or more students, each school contains at least 500 students also three schools in the same building and lack of annual health control program especially for parasitic infections including intestinal parasitosis. These factors perpetuate transmission of H. nana from one child to another by direct contact through contamination of hand or other subjects in school by infected children.

The highest frequency of H. nana infection was observed in school age children in city center and villages than in pre-school age children, but significant correlation was not found. H. nana infection was not found in regions in both ages. This is may be due to the number of samples collected were few. The lowest prevalence of helminthic infections particularly H. nana in pre-school age children may related to the personal hygiene, pre-school age children protected from direct contact with the source of infection by correspondents through attention they offer to stay in home and preventing them from going outside and play with other children.

No significance correlation was found in the frequency of H. nana infection and gender. This result is comparable to these studies (23,31,15,18,14,28,33). The highest rate of infection

was recorded in males than in female, because males are more active in the community, and in continuous contact with surrounding and source of infection, therefore have more opportunity to attract the infection in the community particularly in school.

No marked difference between H. nana infection and source of drinking water was observed. This result is similar to the previous studies (18,28,35). This result may relate to the transmission of H. nana mostly through direct contact (fecal-oral route) from person to person or through contaminated objects.

The highest significance correlation ($P<0.05$) was found between H. nana infection and orphan children; this may be due to poverty, low education level and bad personal hygiene. Close association between helminths infection and poor hygienic practices were reported because most people with low economic standard are those who lack or have low education and do not value simple health promotion practices (31,18,8,28,35).

The Lowest prevalence rate of infection with H. nana was recorded in children whose fathers are employees and H. nana infection was found in children whose mothers are employees. This result is supported by the results of (35), who reported that "level of education of respondents was significantly associated with helminths infection, the low the parents' education, the poorer the children's helminths status".

The concentration (formalin-ether sedimentation) technique was more sensitive and efficient than direct wet mount for identification of eggs of the studies helminths. This result is similar to the results of this study (15). This is due to the size of sample uses for direct wet mount is too small and does not represent all stools particularly in mild to moderate infection with intestinal helminths.

Other intestinal intestinal parasites were found in combination with H. nana infection (double infection) like Entamoeba histolytica, Giardia lamblia and Entamoeba coli. This is comparable with other studies (29,17,36,19,15,20,37,38). There is no clear reason(s) for this association. However, it may be due to the infective stages of these parasites available at the same time (36) and transmission is direct from children to children by fecal-oral route or through contaminated food and water without involvement of intermediate host. The combined infections may be due to the similar growth requirements for each of them, as they prefer the presence of natural commensal bacterial (Streptobacilli) in the digestive system (15).

Patients with intestinal parasitosis become an infection focus for the community, if untreated serious complication and even death may occur due to parasitic infections (8).

In conclusion, the study showed that H. nana and other intestinal parasites were prevalent in school age children more than pre-school. It is therefore suggested that intervention measures have to be adapted to reduce intestinal parasitic infection among children particularly school age children. This may include more research about the intestinal parasitosis in school age children and periodic examination, mass scale deworming and treatment of parasitic infection, continuous health education in school age children and community to improve sanitation and personal hygiene.

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